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REVIEWS.

Road Problems and Methods.

Reviewed by J. WALKER SMITH,* M. Inst. C. E., M. Inst. M. E., F. S. I.

DUST PREVENTIVES AND ROAD BINDERS.—By Prévost Hubbard, Assistant Chemist, Office of Public Roads, U. S. Department of Agriculture. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 416; 51 illustrations in the text. $3, net.

Treating a subject that is at present so prominently before the public notice, not only in America but universally, this book is written by an expert who is well qualified to speak with authority; and it is with pleasure that one is able to record his opinion that the author has—after considerable thought and care in the prepaartion of his matter—given of his best in the work which he now lays before us.

The book is written by a chemist, primarily with the object of furnishing road engineers with a

working knowledge of the characteristic properties of dust preventive and road binders now in use and to develop certain fundamental principles relative to their selection and application.

Strongly as the work will appeal to road engineers, it will but little less strongly appeal to chemists, gas engineers, oil and bitumen distillers and refiners who are concerned with the supply to the road constructor of material which appears destined to play such an important part in the solution of the "Road Problem;" and strongly also should it appeal to state and municipal authorities whose care—and increasingly onerous and difficult duty—is the construction and maintenance of roadway, to meet the conditions of modern traffic.

Well arranged in fifteen chapters, it will be convenient to briefly review the subject matter in chapters categorically:

I. DUST PREVENTION AND ROAD PRESERVATION.—The importance of the problem is emphasized by full consideration of the effects of dust upon property—real and personal—upon vegetation of all kinds and upon the public health and comfort. The ill-effect of dust is now almost axiomatic, and one might almost say there appears to-day nothing—excluding perhaps the domestic fly—which is a greater nuisance and source of danger. The "effects" of dust lead to the discussion of the "causes" and, as a consequence, the author then deals with automobile traffic which—whilst it may or may not be the chief cause of the production—is, with common consent, the chief cause of the dispersion of dust and the immediate cause of the "Problem." Interesting statistics of the growth of the automobile industry are given which show the enormous strides that are being made in this direction, and, although not given, there are similar statistics available in most countries of Europe; all of which go to show that whilst our present problem is the construction of a road capable of carrying a mixed traffic, yet that it is for the automobile traffic—the almost exclusive road traffic of the future—that the road engineer must prepare to cater.

In the conclusion of this chapter it is stated that "indications point toward the evolution of the modern broken stone road to one having a cement base and a bituminous concrete surface." No fault can be found with this, for such are the indications where quantum of traffic will justify the cost, but some roads will never require such elaborate treatment and the surface application of oil or tar will suffice. It is altogether a question of traffic and, so far as finance will allow, the degrees of perfection in construction of dustless roads should be analogous to the arterial system of blood circulation in the human body, where all parts of the body are supplied by channels beautifully graded in size and strength to accommodate the "traffic" which they must carry.

In the meantime, the author points out that the solution of the Dust Problem is possible at present in three ways: (1) Removal; (2) Retention (as by some palliative or surface treatment); (3) Prevention (as by bituminous binders). The third solution is obviously that to be aimed at; meantime the surface treatment will be an important factor during the transition stage and permanently in those cases where traffic will not justify the expense of bituminous-bound construction.

II. CLASSIFICATION OF DUST PREVENTIVES AND ROAD BINDERS.—According to their use, the various dust preventives and road binders have been conveniently classified into three groups: Temporary, Semi-Permanent and Permanent; and according to their chemical characteristics into two groups: Non-Bituminous and Bituminous, and these again are suitably subdivided. The classification is conveniently summarized in tabular form, and representative types of materials falling under the various headings have been stated.

This convenient classification may be well and profitably noted, for the remainder of the book is devoted to the discussion of these materials and their uses.

III. and IV. INORGANIC DUST PREVENTIVES AND ROAD BINDERS.—These chapters discuss and dispose of the first, the non-bituminous, of the two groups into which the various preventives and binders were chemically classified in the last chapter. This group is obviously by far the less important, and in these two chapters the author deals very fully with the inorganic materials of this class, the methods of their application and their relative values, and thus—after a short chapter (V.) upon organic non-bituminous materials—leaves the road clear for the full consideration in the remaining ten chapters of the much more important group, the bituminous materials.

There is nothing new in these two chapters. Much space is taken up in Chapter III. with the cementing value of Rock Dust and in discussing Calcium Chloride: the author's lucid explanations in Chapter III. are, however, very interesting and well worth reading. Chapter IV. is entirely devoted to Hydraulic Cements, which is a subject that has in the past received very full treatment, and no new matter is added. There is certainly emphasized the advantages of cement as binder in foundation course—which is, however, more or less obvious; but the suitability of cement for a wearing surface, whilst having certain advantages, is clearly not suited to horse traffic and heavy traffic of any nature other than that capable of being carried upon resilient tires.

V. ORGANIC NON-BITUMINOUS DUST PREVENTIVES AND ROAD BINDERS.—This is the least important class of dust preventives and road binders and can be dismissed in a few words. Indeed, the author's own words may well be quoted; speaking of this class of materials he says:

Of these, waste sulphite liquor is probably the most important and should be generally available at low cost. Other materials such as animal and vegetable oils will never be employed to any great extent and are relatively unimportant.

VI. HYDROCARBONS.—In this chapter the author describes hydrocarbons in a purely chemical and theoretical manner and classifies the series, giving chemical formulas, the bituminous substances in which the series appear and their general characteristics. The author, in closing this chapter in the following words, "For more detailed information, reference should be made to standard text-books on Organic Chemistry," must have forgotten that he has dedicated his book primarily to road engineers, for the information given in this chapter is already very complete; one does not regret its inclusion, but certainly any further study of the subject in this form would be of doubtful utility to the road maker.

VII. BITUMENS EMPLOYED AS DUST PREVENTIVES AND ROAD BINDERS.—This is a short but very useful chapter, for it helps to clear the air and dispel confusion as to what the generic term "bitumen" includes. The author quotes "Richardson's" definitions, explaining that any definition must be purely an arbitrary one. He explains that, generally speaking, bitumens may be divided into two main classes: (1) natural, and (2) artificial. (1) The former, as would be supposed, occur in a natural state; they occur in gaseous form such as marsh gas, in petroleum form such as paraffin oils, in solid form such as Trinidad and Bermudez asphalt, and in the form of maithas, a product lying between the petroleum and the solid. (2) The latter, "the artificial bitumens," are produced by the destructive distillation of "pyro-bitumens, such as peat, bituminous coal, etc.," or of the bitumens themselves.

The author concludes with a classification of bituminous materials under three main headings: (1) Natural Bitumens, the most important of which for road-making purposes are cyclic oils (asphaltic) and asphaltic substances; (2) Pyro-Bitumens, of which the most importnat is bituminous coal; (3) Artificial Bitumens, of which the most important are water, gas and coal tars and their derivatives from fractional distillation.

VIII. PETROLEUM AND PETROLEUM PRODUCTS.—An interesting review of the huge oil industry of the United States, there is clearly shown in this chapter the unlimited extent of the yield of petroleum. The characteristics of oils from various fields, which are fully explained, vary enormously, and the California oil is the only one that is at all likely to give good results in a crude state. Even that, however, must be accepted with qualification and reservation which the author discusses later. But this chapter indicates the enormous potentialities of petroleum in the Road Problem.

IX. SEMI-SOLID AND SOLID NATURAL BITUMENS.—The ground is well covered in this chapter and the reader is referred for further information upon this branch of the subject to other works which deal exhaustively and exclusively with it.

The use of this material in the future will be largely a question of cost and will undoubtedly be used in localities where it occurs. But it must be recognized that in the past careful and scientific study has been applied to the natural bitumen to the exclusion of the artificial. It is a matter for speculation whether or not the thought and care that are now being devoted to artificial bitumens, which occur throughout the whole country in such large quantities, will not relegate the natural bitumens to a secondary position. It may, however, well be, as one hopes it

*Chief Engineer to the Local Government Board of Scotland; late City Engineer of Edinburgh, Scotland.

will, that healthy rivalry will result in vast improvements in both, to the lasting benefit of road construction—as the advent of electricity stimulated the gas manufacturers and electricians to the healthy competition which has produced the incandescent gas light and the metallic filament glow lamp, to the benefit of all users.

X. THE APPLICATION OF PETROLEUM AND ASPHALTIC MATERIALS.—This chapter deals exhaustively with the surface treatment and construction of earth, gravel and broken stone roads with oil and oil products; costs are given and machines for distribution illustrated. Whilst this is quite readable, it may be said here, and it applies throughout the book, that the author is much less interesting and instructive on questions of road construction than upon the chemical and physical qualities of materials. His style in discussing materials is analytical and judicial and his findings are well reasoned out, but in his comments upon construction he is somewhat dogmatic and, with an "ipse dixit," leaves a statement which is by no means generally accepted by road engineers.

XI. TAR AND TAR PRODUCTS.—This opens an important subject. Interesting statistics of the tar production in the United States and the means of possible augmentation thereof by the adoption of recovery apparatus in the coke ovens are given. The chapter is not quite so up-to-date as it might be, as there is no differentiation between coal tar produced by horizontal, inclined, vertical and chamber systems: these have different characteristics and vary considerably in binding value. Coke-oven tars are scarcely dealt with sufficiently fully, having regard to the enormous potentialities of supply from this source.

In discussing water-gas tars, it is left to be inferred that they are all practically free from naphthalene; this is not generally accepted, as it is found that this deleterious substance, so far as the production of a road binder is concerned, varies enormously in this class of tar. In this chapter, the author's observations upon the results of his experiments under the heading "The Effect of Free Carbon in Tars" are easily the most interesting and valuable in the book. There is food for much discussion in, and discussion will no doubt arise upon, the few pages under this subheading.

The conclusions "logically deduced,"

(1) In the treatment of old road surfaces, a low carbon tar is to be greatly preferred to a high carbon tar [and] (2) in ordinary bituminous road construction, both from the standpoint of efficiency and economy, a low carbon tar is to be preferred to a high carbon tar whose bitumen content is of the same consistency,

whilst well reasoned out, do not appear quite convincing. Table I., which for two tests only gives extraordinarily even results, appears to support the first conclusion. Table III., however, seems to show that free carbon in tar, at least up to 25%, increases the binding strength of the material.

Important as may be, and interesting as undoubtedly is, the effect of percentage of free carbon in tar, there are, as the author points out, many other factors to be considered in determining the relative merits of tars for road work. He rightly points out, too, that laboratory results do not always conform to actual service results. According to the author's figures, it appears that in the United States only about 14% of the tar produced is water-gas tar, which will be the low-carbon tar; the remainder will be gas-house tar which is high-carbon tar. The coke-oven tar will be a "via media" between the two, but at present there is not a big recovery from this source. In England, where much tar-macadam work has been done, the tar used is principally gas house; and it is very clear, without suggesting that a low-carbon tar might not give at least equally good results, that good results are obtainable from high-carbon tar. Comparable figures of results in actual practice are needed and it may be permitted here to call attention to the excellent work of the Committee of the American Society of Civil Engineers in obtaining comparable data—in respect of construction, traffic, cost and analysis of bituminous binder and of aggregate—of practical experiments upon road construction in all parts of the United States. When these results are tabulated and analyzed, the effect of free carbon in various proportions and under various conditions may be made somewhat more clear.

XII. THE APPLICATION OF TAR AND CONSTRUCTION OF BITUMINOUS MACADAM.—In this chapter, the author deals with the surface application of tar and the construction of bituminous macadam roads both by the penetration and the mixing systems; he also gives illustrations of certain tar spraying and tar concrete mixing machines.

Considerable reference is here made to English practice and it is probable that there is a good deal to be learned from the English practice—not only in its successes but also its failures. It must be remembered that, unlike the United States—which has been developed by its railroads—Great Britain was developed largely by its roadways. In and about 1835, when the British railways commenced to extend in all directions, tar was commenced to be used in the construction of roadways and, if the use of roads had not been practically or partially abandoned in favor of the railroad, the science of road-making, including the use of bituminous binders, would not have remained dormant as it has done until within the last few years. The surface tarring, as a temporary expedient in heavily trafficked roads and probably as the permanent solution in lightly trafficked roads, is sufficiently explained. Certain patent and proprietary methods are described, but it is doubtful in a high degree if patent methods and proprietary articles are at all needed or ultimately helpful in the solution of the road problem. Better by far will it be to resort to cogent reasoning, scientific investigation, and rely upon sound principles and practice and not upon patents and proprietors.

The reviewer has not yet seen the enormous machine illustrated as an "auto-portable paving plant," which is designed to dry and heat the aggregate and matrix and to mix them in proper proportions, and which moves under its own steam. The desirability of such a machine is self-evident when the question of freight upon mixed tar-macadam is considered for a moment, but the "portability" of this machine, 29 ft. in length, 10 ft. in width, 10 ft. in height, and purported to weigh about nine tons, but appearing to weigh a great deal more when in service condition, is merely a matter of degree and it certainly does not look as though there is likely to be much demand for such a veritable "Dreadnought" of the road. As one of the many cases in point where the author is less instructive upon the question of road construction than upon the analytical examination of materials, the following may be quoted from his "Conclusions" upon this chapter:

While the mixing method is undoubtedly superior to the penetration method of construction, the latter may often be employed to advantage for roads not subjected to excessively heavy traffic. For heavy highway traffic, the mixing method should be followed, and as has been mentioned earlier in this book, it is probable that the road of the future will consist of a mixed bituminous wearing surface placed upon a cement concrete foundation.

It should be pointed out that, although much English practice has been quoted, mention has not been made of the very excellent results that are obtained by the system of penetration, or grouting of macadam by soft pitch and sand in about equal proportions, which, both with and without concrete foundation, is giving better results than any other method of tar road construction. To the many acquainted with this method, the author's statement will not be acceptable.

XIII. EXAMINATION OF BITUMINOUS ROAD MATERIALS AND INTERPRETATION OF RESULTS.—Fifty pages of interesting and instructive reading are devoted to this all-important part of the subject; the whole trend of the book points to the necessity for examination and standardization of materials. One will be well paid for reading this chapter, but, whilst very complete in detail, it seems to lack one very important test: for adhesion.

In Chapter XI. the author recognizes the necessity for a test for the binding or adhesive or tensile strength of bituminous binder, and one would have thought, setting out from first principles, that the obviously necessary quality of cementing the particles of aggregate together was of primary importance: tests are, however, laid down and discussed at great length for nearly every other quality than adhesion, and it certainly would appear that an adhesion test, which is so positive, should be included. There would not appear to be more difficulty in standardizing conditions for such a test than there is for determining the tensile strength of Portland Cement; and having regard to the fact that it is not a brittle but a tough binder that is required, it would appear reasonable to apply such a test as would give an indication of the action of the binder, not only in initial set but under stress of traffic for which there will need to be elastic and readhesive properties. The author has given us much and consequently we recognize his ability to give us more; and we hope we shall not ask Mr. Hubbard in vain to apply himself to this—as it appears to us—apparent and important omission.

XIV. METHODS OF EXAMINATION PROPOSED OR ADOPTED BY AMERICAN SOCIETIES.—This deals further with the obviously all-important subjects of tests for bituminous binders and contains much information; but more valuable will it become with the publication of the analyzed results of the Committee's enquiries for statistics upon the subject, referred to in notes upon Chapter XI.

XV. SELECTION OF DUST PREVENTIVES AND ROAD BINDERS.—This chapter forms a general discussion of the subject of selection and specification of dust preventives and road binders for different classes of roads; and suggested specifications are given for road tar and road oil. Herein will be found useful matter for the consideration of the engineer, who will need to apply the suggestions to the local conditions obtaining in his district.

Generally speaking, the book is well written: it is very free from printer's errors, although there were a few noticed: such as on Page 260, Resistance to Compression (1), pounds column 2, 7.06 should be 706; and on Page 73, fifth line of second paragraph, dicalcic aluminate (2 CaO. Al_2O_3) seems to have become confused with dicalcic silicate (2 CaO. SiO_2).

The book is well indexed and reflects credit alike upon author and publishers.

ILUSTRITA TEKNIKAL VORTOLIBRI. — Tomo I.: Mashin-Elementi. Ordinara Utensil. Tradukita en Ido, da A. Wormser. Munich and Berlin, Germany: R. Oldenbourg. Linen; 4 × 7 ins.; pp. 52. 1 mark; American price, 40 cents.

Persons interested in the "international language movement" will of course read this booklet. It can be recommended also to those others who may like to see a specimen of what Europe's age-long tendency for producing dog-latin is able to turn out nowadays. "Ido" is stated to be the language here used, and the material which is "translated" is the text portion of one of the Illustrated Technical Dictionaries. The translator should probably be called author, for we assume that he had to invent many new letter-combinations in order to supply this specialized field. Of course it was simple work to do this inventing; apparently the characteristic of the new "language" is to add an "o" wherever possible. "Stopobuxo," "grindostono," "sniflovalvo," "mortopunto," "kavalpovo," "glitofricione" and "rulofricione," "teorio di la rezisto di la materyi," "fuzofero," "Bessemer-stalo," "blanka krudfero," are samples; and, of course, they portray at the same time the universality and simplicity of "Ido." Still more are these qualities evident in "shovostreno." On the other hand elegance is often lacking, as in the words "jantojunto," "hakilokulo," "kunklovagar," "segiletodorso," "glatigrabotilo," "katenroto,"* and "flanjoskrubizuro."

*Nothing to do with either cat, rat or rotten.

Electric Motors and Their Selection.

Reviewed by HENRY H. NORRIS.*

ELEKTROMOTORISCHE ANTRIEBE.—By B. Jacobi, Munich and Berlin: R. Oldenbourg. Cloth; 5½ × 8½ ins.; pp. 341; 172 text illustrations. 8 marks; American price, $3.50.

The application of electric motors to all kinds of industrial requirements has become so general that every manufacturer and every engineer must, at least, be conversant with the general characteristics of such motors. In factories the electric distribution of power has displaced the great line shafts and enormous belts and even individual machine tools and other machines frequently have their own motors. In structural work also, electric drive is useful, as it permits the economical application of large or small amounts of power with greater convenience than any other form of drive, if an electric power plant is available. It is not necessary, therefore, to argue that engineers should keep posted on the rapid developments in motor design and construction.

Electric motor drive has become general for perfectly natural reasons. At first its novelty appealed to some manufacturers, but this has long since worn off. The convenience and flexibility of electric distribution are its most important advantages. Coupled with this is, in many cases, an improved economy as compared with line shaft distribution. Good economy is especially important where energy is brought from a central station. Crocker and Arendt, in their recent "Electric Motors," list a number of advantages of electric as compared with line shaft drive as follows: Saving in power; practicability of using large prime movers; reduced cost of buildings (through the ability to use lighter construction); reduced cost of power equipment; ability to place machines where needed, regardless of location of prime movers; elimination of overhead obstructions such as belts, shafting and pulleys; greater cleanliness; better conditions for employees through reduction of dust and improvement of illumination; ability to supply power to detached and, if necessary, widely separated buildings; freedom for growth of plant without regard to motive power; greater reliability; ability to control the speed of individual machines regardless of the speed of others; ability to increase output by increase of speed of machines; ability to operate part of a plant economically without having to run idle shafting in other parts; and finally, reduced noise, making a factory pleasanter to work in.

As stated above, convenience and flexibility are, from the manufacturer's standpoint, the most important advantages of the electric motor. The motor can be placed at any desired point and it can be belted or otherwise geared directly to its load. Its speed can be adjusted efficiently without shifting of belts by the simple operation of a controller lever. Very delicate gradations of speed can be secured in this way and the machine can be brought to speed from rest gradually but with almost unlimited torque, if such be required. It is difficult to imagine a form of control more perfectly adapted to factory conditions than this. In addition to this perfection of control the portability of electric motors commends them to power users. For example, a machine tool, with its motor, can be moved from point to point, and it is ready for operation when its cable is "plugged into" a nearby terminal box.

The demand for electric motors for industrial purposes has resulted in the production of a large variety of types. When energy is bought from a power company it must, in regard to variety, be taken as it comes. That is, it may be, and usually is, the standard form furnished for lighting, namely, single phase alternating current, of 110 volts pressure and 60 cycles per second frequency. The power plant may furnish three-phase alternating current which is better for power purposes, or it may furnish direct current, which for variable speed work is best of all. Direct current is, however, difficult to get unless supplied from a private plant. Manufacturers of electric motors have thus been forced to furnish motors for all classes of service and adapted to all varieties of current supply. Hence the considerable array of types and the difficulty of choosing the proper one for a given installation, especially if the user has the ability to dictate the variety of current to be used.

Having outlined the field which Mr. Jacobi's book aims to cover, it will be easy to fit the latter into its place and understand its relation to other books on the same general subject. The book is designed to place in the hands of engineers a compendium of information necessary in selecting motors for all the many kinds of work to which they are adapted. The subject matter has been classified with great care. A very elaborate table of contents, occupying twelve pages, shows clearly the author's plan. Among the important topics taken up are: Selection of voltage and current; characteristics and fields of application of various types of motors; types of motor construction; methods of current control and control apparatus; reversal of direction of rotation; braking; speed regulation; maintenance of constant speed, etc. The topics are taken up in a descriptive manner, no mathematics being employed. The author points out the salient features of all modern forms of motor and of all practicable varieties of controller. Accompanying the text are numerous and clear diagrams of circuits and controller connections. There are also curves of motor performance and other illustrations. There are no pictures of control apparatus or motors. The statements are illustrated, wherever possible, by means of numerical problems and in addition, one entire section is devoted to examples for calculation. The practical illustrations are, apparently, based upon the author's experience, and they show in detail the steps to be taken in determining the selection of motors. Wherever possible a tabular synopsis is used to give the reader a perspective view of the subject. A long table, filling nearly nineteen pages at the end of the book, shows the amounts of power required for hundreds of machines. In this table the machines are listed alphabetically. The table should be one of the most useful reference features of the book, for everyone wants to know, now and then, the probable power consumption of one or more machines for which electric motors are to be purchased.

A new book, "Electric Motors," by Crocker and Arendt, referred to above, is similar in scope to "Elektromotorische Antriebe" and it is approximately of the same size. The former goes more into detail regarding motor principles, but has much less detail regarding controllers, and very much less on the requirements of various kinds of load. The two books might well stand side-by-side on the engineer's bookshelf.

*Head Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.

Heat Engines.

Reviewed by LIONEL S. MARKS,* M. Am. Soc. M. E.

HEAT ENGINES.—Steam, Gas, Steam Turbines and Their Auxiliaries. By John R. Allen, Professor of Mechanical Engineering, University of Michigan, and Joseph A. Bursley, Assistant Professor of Mechanical Engineering, University of Michigan. New York and London, England: McGraw-Hill Book Co. Cloth; 6¼ × 9½ ins.; pp. 288; 157 text illustrations. $3, net.

The professors in the American technical schools have adopted very generally the practice of preparing notes on their lectures and of issuing these notes (in mimeographic reproduction) to their students. The present competition for manuscripts among publishers of technical textbooks is resulting in the submission of many of these lecture notes to a larger public. This method of producing books is a good one when the lecture notes have been tried out sufficiently and when the author feels that he has done his best; but with the hunt for manuscripts which is now being pursued so energetically by the publishers, there is much temptation for the author to print work which his own judgment would have left to mature for some time, or, not infrequently, to publish a book which does not satisfy himself.

In such a subject as that of heat engines the possible methods of treatment are infinite and the possible number of good methods of treatment is considerable. Consequently, in dealing with this subject, more perhaps than in any other subject commonly taught in technical schools, we may expect to find the ideas of different instructors divergent. This is the reason for, and the justification of, the numerous textbooks which have appeared on heat engines.

The work under review is a good example of books of this class. It is an amplification of the lecture notes which have been used in the classes at the University of Michigan for a number of years. The transition from lecture notes to a book for the general public has apparently been done somewhat hastily; otherwise certain statements would not have been retained. For example, in the discussion of the Carnot cycle we read: "This cycle has been studied in Physics." That doubtless indicates the practice at the University of Michigan, but is by no means universal.

The work is entirely elementary and introductory in its character. The first two chapters take up "Heat" and "Elementary Thermodynamics" in a brief way which is rather of the character of a review of subjects which the reader is supposed to know already. Some of the general statements in these opening chapters can hardly be permitted to pass unchallenged. On the opening page we find: "As heat is a form of motion it must be possible to transform heat into mechanical motion;" and a little further on "The velocity of the vibration of the molecules of a body determines the intensity of the heat, and this intensity is measured by the temperature." The Carnot cycle, it is stated, "represents the ideally perfect cycle for a heat engine using as a working substance a perfect gas." Such statements must be regarded as evidence of hasty writing, since the authors would certainly not support them.

The order in which the topics are then taken up is as follows; properties of steam, steam calorimeters, combustion and fuels, boilers, boiler auxiliaries, steam-engine types and details, testing of steam engines, valve gears, governors, compound engines, condensers and air pumps, steam turbines, gas engines, and the economy of heat engines. The matter is, in general, well presented but rather inadequately illustrated with cuts taken largely from makers' catalogs. The treatment is in the main descriptive and there is also given some elementary mathematical discussion and analysis. A number of problems are worked out in the text and many others are given at the ends of the chapters to test the knowledge of the student.

*Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

SURVEYORS' TRAVERSE SHEET.—Kolesch & Co., New York; 19 × 15 ins. Ruled sheets. 100 sheets, $3.50.

These sheets are made up in large size on good paper, ruled and lettered for the regular columns used in recording and computing traverses. They should be of considerable value in facilitating the office labor of traverse work.

STANDARD SPECIFICATIONS—For Structural Steel, Special Plate and Rivet Steel; Building, Bridge and Ship Material; Concrete Reinforcement Bars; Forgings, Axles and Wheels; Structural Nickel Steel. Pittsburg, Pa.: Carnegie Steel Co. Stiff paper; 5 × 7½ ins.; pp. 65; two illustrations. Gratis.

This pamphlet contains verbatim copies of the following standard specifications, issued under the auspices of the company and associations named: by the Association of American Steel Manufacturers; "Structural Steel," "Special Open-Hearth Plate and Rivet Steel," "Concrete Reinforcement Bars;" by the Carnegie Steel Co.; "Steel Wheels," "Steel Axles," "Structural Nickel Steel;" and by the American Society for Testing Materials; "Structural Steel for Buildings," "Structural Steel for Bridges," "Structural Steel for Ships," "Open-Hearth Boiler Plate and Rivet Steel," "Steel Forgings" and "Steel Axles." It is a very commendable compilation.

Infection as Related to Sanitary Practice.

Reviewed by C.-E. A. WINSLOW.*

THE SOURCES AND MODES OF INFECTION. — By Charles V. Chapin, M.D., Sc. D., Superintendent of Health, Providence, R. I.; Author of "Municipal Sanitation in the United States." First edition. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ × 8 ins.; pp. 399. $3, net.

The last few decades have marked a revolution in the principles of sanitary science. Efforts at the prevention of disease 30 years ago took the form of a random attack on various kinds of filth, which missed the real causes of preventable disease ten times for once that it chanced to hit them. To-day it is possible for the sanitarian to direct his fire with precision and effectiveness at most, if not all, of the chief communicable diseases. Yet sound theoretical knowledge has only slowly displaced the crude superstitions upon which public-health administration has so long been based. As Dr. Chapin says in his introduction, "present-day theories and present-day practice are maintained largely by tradition," and the purpose of his book is "to facilitate the adaptation of practice to the facts as we now know them."

Dr. Chapin has long been known as an intellectual pioneer among sanitarians and his onslaughts upon the dogmas of the old-fashioned "hygiene" have again and again been received with indignant protest followed by unwilling acquiescence. It is no surprise, therefore, to find that in this book he summarizes the most recent results of laboratory experiment and practical experience and draws from them sound conclusions justified by the present state of the art. The scholarliness with which his conclusions are enforced by detailed citations is, however, the specially admirable feature of this book. In one chapter, taken at random, there are, for example, 319 references in 62 pages. When one remembers that the author is the administrative officer and registrar of vital statistics of the city of Providence, this feature of his work is notable.

Dr. Chapin discusses first the Life of Disease Germs outside of the body and brings out the fact, more familiar perhaps to sanitary engineers than to public-health physicians, that disease germs do not multiply outside the human or animal body but usually die out quite rapidly in any but their normal environment. In the next two chapters he considers the problem of Carriers and Missed Cases which has introduced such new and puzzling problems in health administration and the Limitations to the Value of Isolation now recognized as due to this and other causes. Chapter IV. emphasizes the supreme importance of Infection by Contact, so lately recognized in the case of typhoid fever, and Chapters VII. and VIII. deal with the more familiar Infection by Food and Drink and Infection by Insects. On such vexed questions as the part played by milk in the spread of tuberculosis and by flies in the causation of typhoid fever, Dr. Chapin's conclusions are sound and judicious.

Perhaps the most valuable chapters in the book are the two on Infection by Fomites and Infection by Air. Dr. Chapin begins this discussion by showing how strong the evidence once appeared that yellow fever was spread by fomites. He says:

> The proofs that it is a fomites-born disease were far more numerous and stronger for yellow fever than for almost any other disease. Yet we now know that yellow fever never was, nor could be, transmitted in any such way. Such a mistake, a mistake which cost millions upon millions because of the needless interruption of commerce, and disinfection, should make us careful how on similar, but weaker, evidence, we attribute importance to fomites as a means of infection in other diseases.

The epidemiological evidence of the spread of disease by things rather than by persons proves on examination to be weak, while bacteriological studies make strongly against it. Dr. Chapin's own experience in giving up disinfection after diphtheria in Providence with no disastrous effects points in the same direction; and his final conclusion that "there is no good epidemiological evidence that any diseases except those due to spore-forming bacteria (anthrax and tetanus) are to any great extent transmitted by fomites" seems fully justified by the facts.

Similarly the bogey of air-borne infection fades away before a scientific analysis. Even in the case of small-pox "the evidence in favor of the aerial transmission" "is so slight that it should never influence a municipality in its selection of a hospital site." Dust and mouth spray and sewer gas are shown to be of limited importance; "most diseases are not likely to be dust-borne, and they are spray-borne only for 2 or 3 ft., a phenomenon which after all resembles contact infection more than it does aerial infection as ordinarily understood." We come back to the sick person (or carrier), and his fresh excreta, as the central point of danger. To erect adequate barriers between him and his fellows is the chief task of the sanitarian.

Sanitary engineers will find Dr. Chapin's book invaluable as a manual of the fundamental principles of public-health science, which underlie the work of their own profession; and anything that can be done to get it into the hands of town and city boards of health—which still spend so much time and money on nuisance inspection and plumbing inspection and disinfection rather than on measures which might really save lives—will be a step toward civic efficiency.

*Associate Professor of Biology at the College of the City of New York, St. Nicholas Terrace and 139th St., New York City.

Brief Essays and Addresses on Conservation.

THE FIGHT FOR CONSERVATION.—By Gifford Pinchot. Second edition. New York: Doubleday, Page & Co. Cloth; 5 × 7½ ins.; pp. 147. Net, 60 cts.; postpaid, 65 cts.

As might be expected from author, title and the fact that this little book consists of a dozen occasional addresses and popular articles in current magazines, we have here a series of interesting preachments rather than either a history of the Conservation movement or a detailed program for consistent future action. Some of the chapters do not deal primarily with Conservation, but the subject always comes in more or less prominently in the course of the argument or exhortation. One chapter is headed "Principles of Conservation"; and another is on "Home-Building for the Nation," and one deals with "Waterways."

Naturally considerable space is devoted to Forestry. Here the author reasserts, "No forests, no rivers," just as if his many dicta on the relations between forests and stream flow had never been questioned.

The brief sentence just quoted appears in the chapter on "Waterways," which contains a few paragraphs on the need of a comprehensive plan for waterways development and also on allegations that the U. S. Forest Service has overstepped the federal statutes. These paragraphs will serve as an example of the author's idea and style:

> Every river is a unit from its source to its mouth. If it is to be given its highest usefulness to all the people, and serve them for all the uses they can make of it, it must be developed with that idea clearly in mind. To develop a river for navigation alone, or power alone, or irrigation alone, is often like using a sheep for mutton, or a steer for beef, and throwing away the leather and the wool. A river is a unit, but its uses are many, and with our present knowledge there can be no excuse for sacrificing one use to another if both can be subserved.
>
> A progressive plan for the development of our waterways is essential. Pending the completion of that plan, which should neither be weakened by excessive haste nor drowned in excessive deliberation, work should proceed at once on some of the greater projects which we know already will be essential under any plan that may be devised. First and foremost of these by unanimous consent is the improvement of the Mississippi River. A comprehensive and progressive plan of the kind we need can be made in one way only, and that is by a commission of the best men in the United States appointed directly by the President of the United States.
>
> Such a plan must consider every use to which our rivers can be put, and every means available for their control. . . .
>
> I have observed in the course of some experience that difficulties originating with the law are peculiarly apt to foster misconceptions. It happens that the Forest Service has recently supplied a typical example.
>
> Certain men and certain papers have said that the Forest Service has gone beyond the law in carrying out its work. This assertion has been repeated so persistently that there is danger that it may be believed. The friends of conservation must not be led to [illegible] before the Forest Service can proceed legally with its present work all the hazards and compromises of new legislation must be faced.
>
> Fortunately, the charge of illegal action is absolutely false. The Forest Service has had ample legal authority for everything it has done. Not once since it was created has any charge of illegality, despite the most searching investigation and the bitterest attack, ever led to reversal or reproof by either House of Congress or by any Congressional Committee. Before the creation of the Forest Service the expenditure of nearly $15,000,000 has passed successfully the scrutiny of the Treasury of the United States. Most significant of all, not once has the Forest Service been defeated on any vital legal principle underlying its work in any court or administrative tribunal of last resort. Thus those who make the law and those who interpret it seem to agree that the work has been legal.
>
> When action is needed for the public good there are two opposite points of view regarding the duty of an administrative officer in enforcing the law. One point of view asks, "Is there any express and specific law authorizing or directing such action?" and, having thus sought and found none, nothing is done. The other asks, "Is there any justification in law for doing the desirable thing?" and, having thus sought and found a legal justification, what the public good demands is done. I hold it to be the first duty of a public officer to obey the law. But I hold it to be his second duty, and a close second, to do everything the law will let him do for the public good, and not merely what the law compels or directs him to do.

Whatever one's attitude toward the Conservation question this book is worth the brief time required to read it and the small space it will occupy on the shelf which every comprehensive library must henceforth devote to the Conservation literature.

THE TOWN PLANNING REVIEW.—The Journal of the Department of Civic Design, School of Architecture, University of Liverpool, England. Vol. 1. Liverpool, England: Editorial Offices. Paper; 7¼ × 9 ins.; pp. 86; plates and text illustrations. Subscription price: United Kingdom, 10s. per annum, post free; United States, $2.50 per annum, post free.

At last we have in the English language a journal devoted to town planning, and the publication is worthy of the importance of the subject. Although published by one of the schools of the University of Liverpool and edited by university professors, the journal, which is just now making its first appearance, is in no sense to be considered as a mere organ of that institution. It will, however, afford an outlet for some of the work of the Department of Town Planning and Civic Art in the School of Architecture of the University of Liverpool.

The first number of "The Town Planning Review" consists largely of contributions by professors attached to the university named. The first article is entitled "An Introduction to the Study of Civic Design," and is by Prof. S. D. Adshead. The next article deals with recent town planning schemes in England, including those coming under the general head of "Garden City," and was written by Prof. Patrick Abercrombie. Prof. C. H. Reilly reviews "Contemporary Town Planning Schemes in America." In this review special prominence is given to the recent city planning work for Chicago, done by Messrs. Burnham & Bennett. In fact, the frontispiece to the first number of this review is a reproduction in colors of Jules Guerin's painting of the proposed plaza, at Michigan Ave. and Grant Park. The second number also contains a review of "Town Planning Schemes in America," this time by Prof. Abercrombie. The frontispiece in the second number is a reproduction of the perspective wash drawing of a new design for a group of buildings for the University of Minnesota, Minneapolis, Minn., by Mr. Cass Gilbert.

As some of our readers know, the great reform in town planning in Great Britain has been made possible by recent parliamentary legislation. The Town Planning Act, as this new legislation is called, is given attention in both the first and second numbers of the review before us.

Each of the first two numbers of the Review is well illustrated by plates and also by figures in the text, in addition to the frontispiece already mentioned. The general "make-up" of the Review is pleasing, unless one should take exception to the 5-in. measure (length of each line

of type) used for the greater part of the contents. The section of each number entitled "Chronicle of Passing Events" has two columns to a page, and, although in smaller type than the other portions of the Review, is, on the whole, more easily read.

In the Editorial Foreword we find this statement . . . "In England, unlike Germany and America, there is so far no journal entirely devoted to town planning." . . . We must confess that the editors of the Review were better posted than we and regret that they did not mention the American journal "entirely devoted to town planning."

Six Great Cities.

GREAT CITIES IN AMERICA.—Their Problems and Their Government. By Delos F. Wilcox, Ph. D. Author of "The Study of City Government," "The American City," etc. New York: The Macmillan Company. Cloth; 5 × 7½ ins.; pp. 426. $1.25, net.

Instead of taking up the different phases of city government and activities by sub-topics and bringing in illustrations from various cities, as is usual in books on municipal affairs, Mr. Wilcox has reversed the order and has chosen six of the largest and most important cities of the country as his main topics. This plan has been so successful that we trust the author will carry out his conditional promise and take up a number of other American cities, which, though not so large, are quite as typical and in some respects even more interesting and instructive.

An introductory chapter reviews present-day American cities as a whole. In opening this introductory chapter, the author draws some parallels between the careers of cities and of individuals, and states that "The conditions of the modern world render it doubly necessary that the leadership of communities should be recognized and cultivated." He then discusses the city as a means to an end, and the city as an end in itself. Some scathing words are said here, as elsewhere, regarding the unsavory reputation of American cities. The relation of the great cities of the country to the country as a whole, as well as to democracy and national leadership, is spoken of.

At the close of the introduction, the author characterizes the six cities which he has chosen for review as follows:

(1) Washington, the city made to order, presenting the curious anomaly of being the capital city of a great republic and at the same time having no municipal electorate.

(2) New York, the gateway of the western hemisphere, of world cities the second in population and the first in congestion, municipal debt, and annual expenditures.

(3) Chicago, the inland metropolis, representing better than any other city of the world the gigantic power of the city movement, and standing out preeminent among great cities of America for the curious mixture of civic courage and intelligence in the midst of raw conditions that is characteristic of the United States.

(4) Philadelphia, the Quaker City, the city of brotherly love, the city of homes, the city of thrift, the city of smug respectability, the city that combines with prosperity and traditions of elegance the stolid civic shamelessness that has made it a by-word even where New York is respected.

(5) St. Louis, a typical German-American city in the heart of the country, half South, half North, where trade has been so dominant that the finer types of civic culture have until recently had no opportunity to develop.

(6) Boston, the business center of a great metropolitan district, where the culture and conservatism of New England join hand in hand with the municipal extravagance that is in a measure characteristic of the Irish-Americans.

As might naturally be expected, New York City gets the bulk of the space of the book, or somewhat over one-quarter of the total. Chicago and Philadelphia come next in order, with 60 pages each, and Boston has nearly as many pages. Measured by space alone, St. Louis is given the least attention of any of the cities, and Washington next to the least. The distribution of space seems to be well proportioned to relative importance of the several cities in their relation to the general plan of the book.

In dealing with each city, a general characterization of it is first given, together with a brief general review of its early history and charters. The relation of the city to the state, both as regards constitutional limitations and legislative enactments, is then presented, after which the present form of city government is outlined, with critical comments. This outline generally includes a statement of the powers and duties of the mayor, the city council and various administrative departments. Careful attention is given to such financial topics as taxation, assessment, revenues, expenditures, the tax rate and indebtedness. Some idea of the leading public works of each city is also given.

Many interesting and important salient points in the recent history of each of the cities have been brought out, as: How Alexander R. Shepherd became virtually dictator of Washington, in the early 70's and, riding "rough shod over the conventional restrictions that stood in the way of the realization of his ideas," wrought many much-needed public improvements; how and why Philadelphia came to be known as "corrupt but contented," and why the reform under Mayor Weaver was so short-lived; and how St. Louis was made famous through incidents connected with the pleasant gentlemen's agreement for plunder, with an oath of secrecy attached, as follows:

I do solemnly swear before the Almighty God that in associating myself and in becoming a member of this Combine, I will vote and act with the Combine whenever and wherever I may be so ordered to do;

And I further solemnly swear that I will not at any place or time reveal the fact that there is a Combine, and that I will not communicate to any person or persons anything that may take place at any meeting of the Combine;

And I do solemnly agree that, in case I should reveal the fact that any person in this Combine has received money, I hereby permit and authorize other members of this Combine to take the forfeit of my life in such manner as they deem proper, and that my throat may be cut, my tongue torn out, and my body cast into the Mississippi River.

And all of this I do solemnly swear, so help me God.

It should not be inferred from the foregoing quotation and the remarks immediately preceding it that sensationalism dominates the book. Quite the contrary. There are no more pen pictures of municipal corruption than are needed to give a correct perspective of the government of our great cities or "to point a moral and adorn a tale."

After presenting each city in the manner indicated the author concludes his book by again discussing cities in general, under the title "The Problem of the Great Cities." Here he takes up such matters as city growth, the relation of great cities to concentration of power and, finally, he again considers the relation of great cities to democracy.

The body of the book is a useful compendium of information on the political history, present government and activities, and leading characteristics of the half dozen of our leading cities. The introduction and the conclusion add to the value and vitality of the book and serve admirably to connect its large body of facts and of specific criticism with the great municipal questions of the day.

The Preliminary Report of the Committee on Reinforced Concrete of the Institution of Civil Engineers.

THE INSTITUTION OF CIVIL ENGINEERS.—Preliminary and Interim Report of the Committee on Reinforced Concrete. Adopted by the Council on June 22, 1910. London, England: The Institution (Dr. J. H. T. Tudsbery, Secy.), Great George St., Westminster, S. W. Paper; 5½ × 8½ ins.; pp. 262; three folding plates and numerous text illustrations.

In December, 1908, the Institution of Civil Engineers appointed a special committee

to inquire into the use of reinforced concrete, with a view to a more accurate knowledge of its preparation, strength, properties, and use in engineering work.

The committee was made up of some of the foremost engineers in Great Britain, no one of them, however, specialists in concrete construction. Among the number are Maurice Fitzmaurice, Chief Engineer of the London County Council and one of the Board of Consulting Engineers of the new Quebec Bridge, James C. Inglis, President of the Institution, C. S. Melk, the consulting engineer, Bertram Blount, one of the foremost cement experts in England, and three members appointed by the War Office, the Admiralty and the Local Government Board, respectively. It will thus be seen that is was the intention to make a thorough and considered study of the questions through the medium of eminent practitioners whose broad knowledge and training would guarantee an impartial viewpoint not possible, perhaps, had the committee been composed of engineers specializing in concrete construction.

The program of work, as outlined in the above-noted preliminary report, was: (1) to collect precise information of the principle systems of reinforced concrete now in use; (2) to prepare a comparative analysis of specifications for work in reinforced concrete adopted by the various systems and by various official or governmental rules; (3) to outline the general principles in relation to the materials used and the calculations employed in reinforced concrete; (4) to review the published experimental data on the physical behavior of reinforced concrete; (5) to obtain, through direct examination in open committee, the views of noted specialists in concrete upon their experience in structures which they had built; and (6) to obtain, through printed blanks and instructions, reports on all possible concrete structures.

This, it readily will be seen, is a most ambitious plan which involves the expenditure of much time, labor and money. It can hardly be expected that any definite results will be obtained in a short time; indeed, the care with which the inquiry has been undertaken would show that it is the intention of the Institution to attempt the formulation of such concise rules and opinions as will tend to establish some authoritative standards in a comparatively new industry, a process which calls for no great hurry. Work was started in February, 1909, and had so far progressed by June, 1910, that the above-noted "Preliminary and Interim Report" could be issued. In it is this foreword:

Up to this point the Committee have limited themselves to inquiry into the present location of reinforced concrete as used in engineering structures, and have not sought to formulate any opinion upon the various important questions involved, or to recommend any rules for general guidance in its use.

The 18 months of investigation has served to cover a large part of the six items noted above, as the preliminary study previous to the final report and these are presented in some detail in the report. Included in the 260 pages are tabulations of the details of the various systems now in use in England, a summary of the different governmental orders on concrete design, a resumé of the tests on the behavior of concrete, and the materials which make it up, a nearly verbatim account of the cross examination of various engineers on structures they have built and concise description of twelve different concrete structures, including piers, jetty-heads, bridges, water tanks and reservoirs. Finally, there is a brief bibliography of articles upon reinforced concrete which have appeared in the "Proceedings" of the Institution.

All this has the value of the orderly arrangement of comparable elements. Possibly all of the information gained has been published before, but there is a distinct benefit in having it gathered together under one scheme. With the exception of the description of some British structures, there is little new to the American reader, and the continued insistence on the importance of the patented system is foreign to the American engineer's mind, but taken all in all it is an altogether useful compilation which promises much for the future reports from the Committee.

This report will undoubtedly be compared with the "Progress Report" issued some two years ago by the Joint Committee on Concrete and Reinforced Concrete, formed from four American technical societies, but such a comparison is not quite fair. In 1909, when the American Joint Committee issued its report, it had been in existence for some five years, during all of which time it had had under consideration, to some extent, the matter which it was appointed to study. It had, however, never given but any report on its work and the "Progress Report" of 1909 was without doubt the result of a feeling that it was time to give some account of itself. Unfortunately this account shaped itself into a tentative specification, which is in parts very good but which as a whole seems hardly commensurate with the labor of five years. Such studies, as the Joint Committee made it kept in its own archives, contenting itself with a specification

embodying these studies; a specification, in fact, with which four out of ten members from its most important contributing society disagreed.

The British Committee has entered upon its duties in a typically conservative fashion, and, outwardly at least, in a more thorough manner than the American body, and has presented as its progress report an account of the work which it has done. When five years of its existence have passed it may, too, decide to issue a specification, at which time comparison between the two may be possible. Until then we can only contrast the voluminous tables, summaries and report in the book before us, with the purely routine progress reports annually made by the American Joint Committee.

The Story of the Telephone.

THE HISTORY OF THE TELEPHONE.—By Herbert N. Casson, Author of "The Romance of Steel," "Cyrus Hall McCormick, His Life and Work," "The Romance of the Reaper," etc. Chicago, Ill.: A. C. McClurg & Co. Cloth; 5½ × 8¼ ins.; pp. 315; 29 plates. $1.50, net.

An engineering reader is apt to be very critical in judging the work of a newspaper writer who attempts to describe an engineering development like the rise of the telephone. Consequently there might have been expected in Mr. Casson's book a great deal of matter so inexact and so inadequate as to be irritating to any one to whom the inconsistencies are apparent. Of such is the opening chapter in which Alexander Graham Bell is made to bear the torturing pains of travail in giving birth to this invention. There is so much here of the "whoop-la" and the "presto" style of writing to cover paucity of fact that a bad impression is given—an impression, however, that is more or less dissipated as Mr. Casson gets on grounds more comprehensible to a man without engineering training or instinct. Bell's work in vocal acoustics, in telegraphy and in the development of his first telephone are jumbled together hopelessly. He is introduced, as of the year 1875 on the occasion of what Mr. Casson is pleased to picture as the moment of birth of the instrument, but he is set back once or twice to the land of his birth and in 1871 Alexander J. Ellis in London is made to tell Bell that the latter's work (that of 1875 we suppose) has already been done by the great Helmholtz.

The book, so far as it traces the commercial development of the telephone industry, is indeed interestingly written and in a way that holds the reader's attention. The hardships and faith of Sanders and Hubbard, who backed the inventor until success was reached, the herculean work of Theodore Vail, the onslaughts of the Western Union Co. and of all the host of rival claimants are most interestingly described. The book abounds in pen pictures of the men who have figured prominently in the development of the telephone, others than those already named, Chauncy Smith, James J. Storrow and T. D. Lockwood, the patent experts, Thomas Watson, E. T. Gilliland, Enos M. Barton, the instrument makers, Emile Berliner and Francis Blake, who gave the company its transmitter, J. J. Carty, John A. Barret, Thomas Doolittle, Charles E. Scribner, and M. I. Pupin, who solved the intricate engineering problems which from time to time have impeded the development of this art of universal immediate communication.

The author is sympathetic in his discussion of the attempts of the American Telephone & Telegraph Co. to gain a practical monopoly in the telephone industry in this particular public-utility service. Throughout the book statistics have been freely used, but mere figures are seldom found to stagger the imagination, they are, rather, embodied in apt and homely comparisons.

One may be surprised, after reading three-quarters through the book, to find the superficial treatment which has been accorded the subject of rates, for one might expect that Mr. Casson would here at least be quite at home. What he calls the keynote of equitable rates and puts as such in italics is this:

Every telephone anywhere adds value to every other telephone on the same system of wires.

Later he adds, as his "philosophy of rates" which he recommends to legislatures and companies everywhere, that "the whole must carry the whole;" meaning by that, we suppose, only that profitable subscribers must carry unprofitable ones, such as hospitals, police and fire stations, public offices, etc.

Those statements are true, so far as they go but, as made here and unqualified, they are extremely misleading. The recognized idea, seen indeed more or less clearly in the monopoly's practice, is the segregation of subscribers into classes, according to their demands of service, for the imposition of rates based on the cost of service for the average member of the class plus a reasonable profit. As a part of the administration expenses, which each subscriber has to bear, is this cost of certain unprofitable service like that in hospitals, fire and police stations, etc. These things, however, are so small as to be almost negligible. It is not fair, however, as has been the case in Massachusetts, to make the rates for one class very low and for another class very high so that the first class has its service at the expense of the second. The whole may carry the whole and still injustice may prevail. It is better to say that each class must carry that class, that each locality must carry the locality, that toll service must carry toll-line plant. Mr. Casson has missed a rare opportunity to do a great service for the company and the public in passing over rates so lightly.

We presume that this book will have a large circulation, in spite of the few weaknesses we have mentioned. These points are not ones that greatly concern the general public. The book deserves a ready sale, even if for no other reason than that it discloses the maturing plans of a generally beneficent monopoly.

Two French Mechanical Books.

GUIDE DE L'AJUSTEUR (Guide for the Fitter and Machinist).—By Jules Merlot, Mechanical Engineer. Paris: Librairie Polytechnique Ch. Beranger (15 Rue des Saints Peres). Second Edition. Cloth; 6¼ × 9¾ ins.; pp. 360, with 570 cuts in the text. 10 francs; American price, $3.

This is a book for the machinist and shop foreman, dealing especially with the work of the fitter. It is a companion to the "Guide of the Erector" by the same author. It covers the laying out of work, and the use of calipers, gages, squares. Also such hand tool work as chipping, scraping, drilling, tapping, etc.

COURS DE MECANIQUE (A Treatise on Mechanics).—By L. Guillot, Professor of Mechanics at the National School of Arts and Trades. Paris Librairie Polytechnique Ch. Beranger (15 Rue des Saints Peres). Vol. I. Cloth; 6 × 8¾ ins.; pp. 428, with 279 cuts in the text. 10 francs; American price, $3.

This work is arranged to conform to the methods of the National School of Arts and Trades (France). The first volume, now issued, deals with the general principles of graphic statics. In the first part are discussed mass, force, friction, gravity, inertia, etc. Then comes the part on graphic statics, with the determination of stresses. The remainder is devoted to torsion, tension, compression, bending, etc., as applied in the design of tank plates, gearing, riveting, engine bed plates, flywheels, and other mechanical parts. The printing (and especially that of the formulas) is clear and distinct, and the lettering of the cuts is commendably clear. A criticism of some French and German technical works is that the lettering of cuts is much too small, but in this book it is very legible without being obtrusively large. The book itself, although having over 400 pages, is compact, light and easy to handle.

THE OHIO STATE CANALS.—71st Annual Report of the State Board of Public Works (Ohio). Pub. Doc. Columbus, O. Paper; 6¼ × 9¼ ins.; pp. 245; illustrated.

This relates to the canals, canal improvements and canal lands, and is for the fiscal year ending with Nov. 15, 1909. It includes the report of the Board, the reports of the Chief Engineer and his assistants, and about 120 pages of itemized statements of expenditures. The illustrations include maps, profiles and sections, and half-tone engravings of the improvement work.

A College Text-Book for Engineers on Contracts and Business Law.

CONTRACTS IN ENGINEERING.—The Interpretation and Writing of Engineering—Commercial Agreements. An Elementary Text-Book for Students in Engineering, Engineers, Contractors and Business Men. By James Irwin Tucker, B. S., LL. B., M. E., C. E., and Assistant Professor in Civil Engineering at Tufts College. First edition. New York and London, England: McGraw-Hill Book Co. Cloth; 6¼ × 9¼ ins.; pp. 307; $3, net.

It probably will be accepted without argument that the technical training of an engineer is about the worst possible out of which to make a lawyer. The engineer is trained to deal with the forces of nature and the laws of material which, though not always easily interpreted or understood, are unalterable. It is therefore extremely difficult for him to harmonize his mind to the intricate processes of man-made law. Particularly is it hard for him to comprehend how the rights in any one particular case are to be determined from the mass of conflicting rulings in similar cases in the past. Unfortunately, it has also been supposed that this same technical training would not be applicable to a business career. Time and again has a brilliant and successful engineer found his way toward promotion blocked by the feeling on the part of his directors that only a "business man" should be placed in an executive position. Of late, this idea seems to be losing ground. It is readily seen that the logical and precise training of the engineer is just that necessary to the business life, provided the engineer has not drawn into the shell of his special occupation and neglected to acquaint himself with those rules by which the commercial relations of the world are regulated.

Recognizing this very necessary part of the modern engineer's education, most of our technical schools now include in their curriculum a course in engineering jurisprudence, consisting solely of instruction on those very limited portions of the law which pertain to the contract ordinarily drawn up between a contractor and the owner of a structure about to be built. Some colleges, going further, are recognizing the potential business man in the technical graduate, and specify a course which includes not only the mere contractor-owner agreement, but also as collateral matter the fundamentals of the principles of the law required in the orderly transaction of business.

It is for this latter class of instruction that Prof. Tucker's book is intended as a text. About a third of it is devoted to the law of contracts, mainly as they pertain to the engineer. About a third is devoted to the underlying principle of writing the so-called "contract," which, as Prof. Tucker rightly observes, should include both the contract and the specifications, the two being hardly separable. The remaining third is given over to the principles of agency, tort and real property, since, as the author says, "These bear an intimate relation to the engineer's work wholly aside from his rights and obligations arising under contracts generally."

By his own acknowledgment, the author is indebted to the somewhat analogous works by Wait, Johnson and Waddell; from our own examination we would say more particularly to the first of these than to the latter two. But, unlike any of these three, his treatment is primarily for college study. He says:

The object has been to provide a text-book suitable in form and subject matter for use in engineering schools. . . . In preparing these outlines of contract law, a two-fold purpose has been kept in view: First, to make matter and statement such as will be readily intelligible to the average college student, who has no opportunity for extended study of legal principles; second, to present such facts and rules as seem likely to be of most value to him in his future professional and business career.

This collegiate nature has been further amplified by the inclusion at the end of each chapter of a number of quiz questions which thoroughly cover the matter taken up in the chapter. These questions have been selected with considerable care, and should without doubt prove of great aid to the student.

This portion of the book on contract law, while not differing considerably from the other authorities, has been reduced to the lowest possible terms. It covers very fully the subject, and without undue diversion into the complications which arise when different courts give different decisions on practically the same question.

The section on business law is very valuable. After studying it the student of engineering may know something about the intricacies of partnership, corporations and negotiable paper—matters which have not always been a part of the engineer's knowledge.

The last section, on the writing of engineering contracts and specifications, is an attempt to fill a very necessary want. This subject is ordinarily taught by the study of specific contracts and specifications made by eminent engineers or corporations. Prof. Tucker, however, only refers to contracts already written in a limited way, and devotes his entire attention to noting the necessary points to be covered in such work and the general manner in which the wording should be made. One large specification is taken up and reduced to its lowest terms so that a general idea may be gained of what such a specification covers.

In view of the short time which ordinarily can be allowed in an engineering course to this study of engineering law, the books heretofore available have been generally altogether too long. For reference work in the days of his practice, the engineer may, and undoubtedly does, obtain great value from them, but during his student days he has not the time, nor the ability, perhaps, to gain much from them. In view of this fact, we think that Prof. Tucker's book is particularly desirable. It is comparatively short, and is not above the capacity, mental or physical, of the average engineering student.

MODEL BALLOONS AND FLYING MACHINES.—With a Short Account of the Progress of Aviation. By J. H. Alexander, M. B., A. I. E. E., Author of "Model Engine Construction, and Elementary Electrical Engineering." New York: The Norman W. Henley Pub. Co. London, England: Crosby Lockwood & Son. Cloth; 5½ × 7 ins.; pp. 127; 5 working drawings and 45 text illustrations. $1.50.

While Mr. Alexander has not taken up the construction of real flying machines of size, yet he has deemed it necessary to make a recompilation of the early history of aeronautics. As several good books are to be found on library shelves containing this history in just as accessible and fully as attractive and authentic form, it is difficult to see why it was necessary to burden this book with such material. Some of the statements in the historical part are peculiarly vague and apparently uninstructive; for instance, where, in writing of the use of parachutes, it is stated

> In 1837, Mr. Cocking descended near London from a parachute suspended from Mr. Green's Nassau balloon . . . Prof. Baldwin descended from a parachute several times in 1888 at the Alexandria Palace, London. We saw a balloon ascent and a parachute descent made from Queensborough, Glasgow, in 1893.

In the main part of the book, first, the author describes how to make a model fire balloon and gives a pattern for the paper gores, etc. A toy drifting balloon, filled with hydrogen or illuminating gas, is given considerable space.

Before passing to model aeroplanes, the author finds it necessary to give a history of the development of aeroplanes in general, and to show a few details of the construction and operation of several important types. For a book published late in 1910, it is surprising that records are given only up to November, 1909. The author might have expected that records would be made and broken weekly so that it would hardly be of benefit to more than mention the order of magnitude of achievements and the probable limitations had he dared prophesy. The model aeroplanes, whose description fills the larger part of the book, are intended to reproduce in miniature the Farman, Voisin and Wright biplanes and the Blériot monoplane. A series of working drawings for the several model machines noted is appended.

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Factory Organization and Administration

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CONTINUED ON NEXT PAGE

Railway Rates and Railway Wreckers.

CONFIDENCE, OR NATIONAL SUICIDE?—By Arthur Edward Stilwell, New York: The Bankers Publishing Co. Cloth; 5½ × 8 ins.; pp. 120. $1, net.

There is little to connect these short essays, except a frequent refrain in the form of a protest against any reduction in railway rates and repeated uncomplimentary remarks on Wall St. bears and wolves.

The author points to Mexico and to President Diaz of that republic as the grand examplars of governmental dealings with the railroads. Mexico, he says, has established stability in railway matters by granting concessions which fix railway rates for 99 years. The author suggests fixed rates for 30 years in the United States, but later on he modifies this suggestion in an essay called "Fixed Traffic Rates for Fifteen Years." We quote the last two paragraphs of this essay, both as exhibiting the author's line of argument and as showing how the book got its startling title:

> This country is growing fast and nothing helps its growth like proper transportation facilities. James J. Hill says that $500,000,000 needs to be expended by American railroads in the next ten years. I believe it. If some law could be passed calculated to overcome the distrust regarding our securities, this money could be found here and in Europe. It will not remain uninvested, but failing us will go to upbuild Argentine, Chili, Brazil, Africa or Russia. We could secure this gold if a slight advance in traffic rates were allowed and assurance given of "hands off" for fifteen years. The Erie needs $30,000,000 and could get it; the Santa Fe could finish its double track, which plan, the English papers said, was abandoned, when the proposed raise in rates was enjoined. The Union Pacific and other roads would expend millions.
>
> Would you object to this slight increase in freight rates, which amounts to 1/16 of the present schedule? Would you feel the trifling increase of one mill per mile in passenger rates? I believe no. Your assent would secure prosperity—the like of which has never been witnessed! Our bonds and shares would take their proper place at home and in the eyes of foreign investors and we would permit railroad development to keep pace with the rapid growth of the nation. The great prosperity now enjoyed by Canada would be secured for the United States and Confidence would supplant National Suicide.

Two of the essays defend watered railway stock. One of these, entitled "On Which Side of the Fence is the Water," seeks to show that the increase in land values, etc., which follows a pioneer railway are many times greater than stock inflations or waterings by the railway promoters: hence there is more stock watering, or its equivalent, on the farmer's side than on the railway's side of the right-of-way fence. Besides all this, the author presents the familiar argument that he who takes great risks is entitled to great returns, etc. The author does not seem to realize that the settlers benefit the railway as much as the railway the settlers and that the settlers run their risks, also. Nor does he realize what a splendid line of argument he is developing for the single taxers, on the one hand, and for the advocates of government ownership of railways, on the other.

In general, the author arrogates to the railways all credit for the wealth and prosperity of the country and the sole right to determine what are fair rates and regulations. He even goes so far as to declare that recent shippers protests against increases in rates did not really come from the shippers, but was worked up by secretaries of chambers of commtrce who wished to seem to be doing something for their constituency. Similarly, he would like his readers to believe that it is not the public in general but political demagogs who are responsible for the demands for legislative interference with the railways. No wonder there is bitterness between the railways and the people when one of their representatives takes such a position. Fortunately, there are comparatively few railway men of influence who go this extreme.

The Use of the Steam Engine Indicator.

THE STEAM ENGINE INDICATOR.—F. R. Low, Editor of "Power and the Engineer." Third edition, revised and enlarged. New York: McGraw-Hill Book Co. Cloth; 6¾ × 9¾ ins.; pp. 160; 144 illustrations; tables. $1.50.

In examining the series of articles which form the chapters of Mr. Low's book, it appears that an attempt has been made to supplement rather than to supplant the more theoretical manuals of the steam-engine indicator which are used in the engineering schools of the country—books like Peabody's Manual, containing descriptions of the several designs of indicators with discus-

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sions of the properties of air and steam and of the theories of parallel and reducing motions, etc. Mr. Low's book will possibly be found of more immediate benefit to the operating engineer than the manuals noted, which would be found of more service in engineering schools, as its discussions are primarily for the practical man who desires to use the indicator as a handy instrument for studying the operation of his steam engines with a view to correcting poor adjustments and for ascertaining the work done. As might be expected, therefore, there is little or nothing on the theory of the indicator.

The book starts out with directions for trying an indicator, which it is proposed to purchase, to see if it has the desirable requirements of lightness of working parts, freedom from friction and lost motion, parallel and proportional movement between the indicator piston and pencil point, etc. Then the author discusses the several reducing motions which are available for representing in miniature the actual travel of the engine piston. The proper ways of attaching the indicator to the cylinder and to the reducing motion are described. The different parts of the diagram given by the indicator in action, such as the admission, expansion, compression and exhaust lines, are shown as they should be and as they are commonly found, to point out the troubles met with in steam-engine practice and their remedies. One notable feature of the book is a transparent sheet showing hyperbolic curves for the expansion of steam, so arranged that a direct comparison may be made between the actual expansion line of a card and the theoretical line for the particular vacuum and clearance lines.

As one of the principal uses of the indicator diagram is for determining the power of an engine, the author devotes considerable space to use of the diagram for obtaining the mean effective pressure during a stroke. As a part of this discussion, there is a chapter descriptive of planimeters, complicated and simple. The so-called "hatchet" planimeter, a simple, easily made apparatus, which has been found of service, is given a prominent place. After this, the author very simply presents the computations necessary for figuring horsepower and steam consumption. To facilitate these calculations, various tables are reprinted.

The final chapters of the book are given over to such topics as diagrams from compound engines, neglecting and considering clearance, errors in the diagram and methods of measuring the clearance of an engine.

PRACTICAL DATA FOR THE CYANIDE PLANT.—By Herbert A. Megraw, B. S., A. I. M. E., Mining and Metallurgical Engineer. New York: McGraw-Hill Book Co. Flexible Morocco; 4¼ × 7 ins.; pp. 93; 25 text illustrations; tables. $2, net.

While it seems to have been the authors' aim to give a convenient compendium of data for the cyanide-mill man, yet all who pick up this little volume will find that he has prepared a most interesting and readable resume of processes and machinery for the extraction of gold and silver values from ores with the help of potassium or sodium cyanide. On this account alone, we believe the book will recommend itself to all those who need to have handy an outline of the actual work of crushing and grinding, separating the coarse and fine particles (sand and slimes), leaching the sand, agitating the slimes with the cyanide solutions, and precipitating the valuable metals. A description is given of the prominent pieces of apparatus, old and new.

The chemistry of the process is but lightly touched upon as would be expected from the size of the book, but there is a practical outline of the requirements for various solutions of potassium or sodium cyanide. Among the most helpful parts of the book, to the man who has been denied a good metallurgical training, are the short sections on preliminary experiments upon ores to develop the most economical treatment and on the troubles that are apt to arise in actual mill work.

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Publications Received.

AMERICAN CIVIC ASSOCIATION.—City Planning. An introductory address delivered by Frederick Law Olmsted at the second National Conference on City Planning and Congestion of Population, at Rochester, N. Y., May 2, 1910. Washington, D. C.: The Association. (Union Trust Bldg.). Paper; 5 × 8 ins.; pp. 20. 25 cts.

ANNUAL REPORT OF THE CHIEF OF BUREAU OF MANUFACTURES.—To Hon. James Nagel, Secretary of Commerce and Labor, for the Fiscal Year Ended June 30, 1910. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 23.

APPLIED STATICS.—By T. R. Loudon, B. A. Sc., A. M. Can. Soc. C. E. Second edition. Toronto, Canada: The Canadian Engineer Press. Cloth; 6 × 9¼ ins.; pp. 164; 32 text illustrations. $1.50, net.

APPLIED THERMODYNAMICS.—By H. W. Spangler, Philadelphia, Pa.: John Jos. McVey. Cloth; 6 × 9¼ ins.; pp. 160; 76 text illustrations. $2.50, net.

APPLIED THERMODYNAMICS FOR ENGINEERS.—By William D. Ennis, M. E., M. Am. Soc. M. E. New York: D. Van Nostrand Co. Cloth; 6½ × 9½ ins.; pp. 438; 316 text illustrations. $4.50, net.

THE ART OF ROADMAKING.—Treating of the Various Problems and Operations in the Construction and Maintenance of Roads, Streets, and Pavements. Written in non-technical language, suitable for the general reader; with an extensive bibliography and a descriptive list of reliable current books and pamphlets on these subjects. By Harwood Frost, B. A. Sc., M. Am. Soc. M. E. New York: The Engineering News Publishing Co. London, England: Constable & Co., Ltd. Cloth; 6 × 9¼ ins.; pp. 544; 254 text illustrations; 5 appendixes. $3, net.

ASSOCIATION FRANCAISE DU FROID.—Station Expérimentale Du Froid à Chateaurenard. By J. De Loverdo, Ingénieur, Secrétaire Général de l'Association. Paris, France: The Association (10, rue Denis Poisson). Paper; 6 × 9½ ins.; pp. 20; 13 text illustrations.

BULLETINS NATIONAL BOARD OF FIRE UNDERWRITERS.—Edition of 1910. New York: The Board. Paper; 3½ × 5½ ins.

RULES AND REQUIREMENTS as recommended by its Committee of Consulting Engineers for the Construction, Installation and Use of:
- Acetylene Gas Machines, and for the Storage of Calcium Carbide; pp. 32.
- Gasolene Vapor Gas Lighting Machines, Lamps and Systems; pp. 30.
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RULES AND REQUIREMENTS as recommended by the National Fire Protection Association for the Construction and Installation of:
- Gravity Tanks; pp. 22; one illustration.
- Sprinkler Equipments (Automatic and Open Systems); pp. 50; six illustrations.
- Valves, Indicator Posts and Hydrants for Mill Yard Use; pp. 32; six illustrations.

BULLETIN U. S. GEOLOGICAL SURVEY.—Geo. Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5⅜ × 9 ins.; pp. 282; 46 plates (4 maps); 20 text illustrations (4 maps).

No. 426: Granites of the Southeastern Atlantic States. By Thomas Leonard Watson.

CENTRAL ELECTRIC LIGHT AND POWER STATIONS 1907.—Special Reports. Bureau of the Census, Department of Commerce and Labor; E. Dana Durand, Director. Washington, D. C.: Pub. Doc. Cloth; 9¼ × 12 ins.; pp. 194; 148 tables, 3 maps, 7 diagrams, 26 illustrations and 2 appendixes.

THE CONSERVATION OF NATURAL RESOURCES IN THE UNITED STATES.—By Charles Richard Van Hise. Madison, Wis. New York: The Macmillan Company. Cloth; 5½ × 8 ins.; pp. 413; 16 plates and 20 illustrations. $2, net.

THE CONSTRUCTION OF GRAPHICAL CHARTS.—By John B. Peddle, Professor of Machine Design, Rose Polytechnic Institute. New York and London, England: McGraw-Hill Book Co. Cloth; 6½ × 9½ ins.; pp. 109; 58 text illustrations. $1.50, net.

ELECTRIC MOTORS.—Continuous, Polyphase and Single-Phase Motors, Their Theory and Construction. By Henry M. Hobart, M. Inst. C. E., Consulting Engineer. Second edition, entirely rewritten, revised and enlarged. New York: The Macmillan Co. Cloth; 6 × 9 ins.; pp. 748; 798 text illustrations. $5.50, net.

FORMULAIRE POUR LA CONSTRUCTION DES AEROPLANES.—By A. Guironnet. Paris: Librairie Aeronautique, 32 Rue Madame. Paper; 5 × 7½ ins.; pp. 163; 32 text illustrations. 3 francs; American price, 90 cts.

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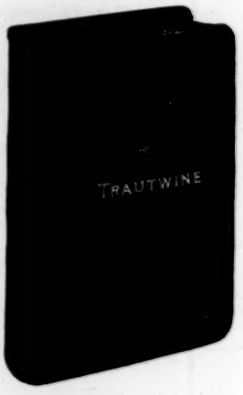

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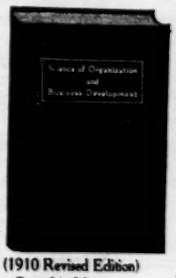

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